

Ultramafic rock in the Hida metamorphic belt: an example of arc plutons

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We report petrology and mineral compositions of ultramafic rocks in the Hida metamorphic belt, which was metamorphosed at around 235-250 Ma (Takahashi et al., 2018, Island Arc). It was pointed out in a graduation thesis of Kanazawa University that a small ultramafic body exists in the Hida metamorphic belt of Ozoe area, Hakusan City (Nagaoka, 1970). A preliminary result revealed that this ultramafic rock of the Hakusan City is mainly composed of large poikilitic amphibole grains enclosing many olivine grains, which are traditionally called as cortlandite (Williams, 1893 Jour. Geol.). These amphibole-rich plutonic rocks are expected in deeper part of island arc (e.g., Davidson et al., 2007 Geology). In fact, cortlandite and/or amphibole-rich plutonic rocks in granitic rocks/felsic metamorphic rocks were reported from all over the world (e.g., Tiepolo et al., 2011 Jour. Petrol.). Although these formation ages are different, it is noticed that they formed at convergent plate boundaries (Tiepolo et al., 2011). Cortlandite is minor but is reported from the Ryoke metamorphic belt, Japan (e.g., Kutsukake, 1978, Memoir. Kyoto Univ. Ser. Geol. Mineral.). Cortlandite and related amphibole-rich rocks would shed light on magmatic processes occurred beneath island arcs.

Ultramafic rocks of the Hakusan city (simply call Hakusan Ultramafic rock hereafter) is mainly composed of large poikilitic amphibole and orthopyroxene enclosing olivine grains. These olivine grains contain chromian spinels. Olivine with spinel existed phases before amphibole and orthopyroxene were crystallized. Orthopyroxene are sometimes included in amphibole and amphibole shows euhedral shape against the next orthopyroxene grain indicating amphibole is an early crystallization phase. The Fo content of olivine is around 84 and XMg of amphibole is around 90. High XMg of mafic minerals indicate that the Hakusan Ultramafic rock was formed from a relatively primitive melt. Poikilitic amphibole is pargasitic in composition. Calculated melt compositions from trace element compositions of the poikilitic amphibole are characterized by high in LILEs with negative anomalies of HFSEs, and are similar to arc magmas. We concluded that the Hokuriku Ultramafic rocks are formed from arc-related magma. It is important to study the origin of cortlandite and related amphibole-rich plutons from other metamorphic belts with different ages to understand the differences in mode and conditions of arc formation.